JANGJAE LEE

Postdoctoral Research Fellow

Infrastructure Resilience & Machine Learning

University of Houston • Department of Civil and Environmental Engineering
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EDUCATION

Ph.D. in Civil Engineering — 2020–2025

Texas A&M University, College Station, Texas, United States

Dissertation: Machine Learning-Based Decision Support: Modeling and Analysis of Power Outages in Texas Under Extreme Climate Conditions

Advisor: **Dr. Stephanie G. Paal** **Excellence Fellowship (2020–2024)** **Dissertation Fellowship (2024–2025)**

M.S. in Architectural Engineering — 2016–2018

Hanyang University (Seoul), Seoul, South Korea

Thesis: Seismic Performance of Exterior Beam-Column Joint Subassemblies Reinforced with Steel Fibers

Advisor: **Dr. Chang-Sik Choi** GPA: **4.25/4.5** **HY-in Scholarship**

B.S. in Architectural Engineering — 2010–2016

Hanyang University (ERICA), Ansan, South Korea

GPA: **3.67/4.5** **Honor Scholarship (2015–2016)**

RESEARCH INTERESTS

Machine Learning for Critical Infrastructure Resilience • Power Grid Analytics & Forecasting under Extreme Weather • Climate-Informed Multi-Hazard Risk Modeling • Explainable AI for Decision Support Systems • Machine Learning for High-Performance Materials • Machine Vision for Infrastructure Inspection • Large Language Models for Emergency Planning after disaster • Quantum Computing for Infrastructure Resilience Optimization • Community Resilience Assessment • LiDAR & Geospatial Data Fusion

PROFESSIONAL APPOINTMENTS

Postdoctoral Research Fellow — Sep 2025–Present

University of Houston • Department of Civil and Environmental Engineering, Houston, TX

Principal Investigator: **Dr. Abigail L. Beck**

Developing comprehensive data-driven frameworks for infrastructure and community resilience assessment integrating multi-source data (311 service requests, LiDAR, machine vision, meteorological data, census data). Research focuses on infrastructure quality estimation, outage impact modeling, and field-based validation employing statistical and empirical methodologies across multiple infrastructure systems.

Research Intern — May 2024–Aug 2024

Oak Ridge National Laboratory, Oak Ridge, TN

Mentor: **Dr. Sangkeun M. Lee**, Senior Staff Data Scientist

Conducted national-scale power grid resilience analysis within the Grid Resilience Research group. Developed interpretable machine learning models for critical energy infrastructure systems. Gained specialized knowledge in power system stability and sustainability. Contributed to a peer-reviewed journal paper and a conference publication on resilience enhancement.

PUBLICATIONS

Peer-Reviewed Journal Articles

[J1] **Lee, J.**, Zhang, Z., & Paal, S.G. (2025). *A data-driven approach to predicting power outages during winter storms in the southern U.S. leveraging nonparametric machine learning models.* *Computational Urban Science*, Springer. https://doi.org/10.1007/s43762-025-00222-9

[J2] **Lee, J.**, Lee, S.M., Chinthavali, S., & Paal, S.G. (2025). *A near-real-time model for predicting electricity disruptions in Texas during winter storms.* *IEEE Access*, 13, 139583–139603. https://doi.org/10.1109/ACCESS.2025.3596531

[J3] Son, D.H., Bae, B.I., **Lee, J.**, & Choi, C.S. (2024). *Shear strength of steel fiber-reinforced concrete exterior beam-*

column joints with various anchorage details under cyclic loading. *Structures*, 61, 105940. https://doi.org/10.1016/j.istruc.2024.105940

[J4] **Lee, J.**, Bae, B.I., & Choi, C.S. (2018). *An experimental study on the seismic performance of reinforced concrete exterior beam-column joints with steel fiber volume fractions.* *Journal of Architectural Institute of Korea*, 34(4), 15–23. https://doi.org/10.5659/JAIK_SC.2018.34.4.15

Manuscripts Under Review

[R1] **Lee, J.**, Lee, S.M., Chinthavali, S., & Paal, S.G. (2025). *An integrated model for predicting power outages caused by various types of extreme weather events.* **[R1 Revision]**

Manuscripts in Preparation

[P1] **Lee, J.**, & Paal, S.G. (2025). A knowledge-based predictive model for estimating power outages due to various hazardous weather events.

[P2] **Lee, J.**, & Beck, A. (2025). Community resilience to natural hazards using 311 reports and big data analytics.

[P3] **Lee, J.**, & Beck, A. (2025). U.S. infrastructure quality estimation in coastal regions using LiDAR data fusion.

[P4] **Lee, J.**, & Son, D.H. (2025). Knowledge transfer predictive model for the shear capacity of steel fiber reinforced concrete beams.

PRESENTATIONS & CONFERENCE ACTIVITIES

Peer-Reviewed Conference Proceedings

[CP1] **Lee, J.**, Lee, S.M., Paal, S.G., & Chinthavali, S. (2024). *A generalized outage prediction model for various types of extreme climate events in Texas.* In *Proceedings of the 2024 IEEE International Conference on Big Data (BigData)*, pp. 4162–4166. IEEE. https://doi.org/10.1109/BigData62323.2024.10825479

[CP2] **Lee, J.**, & Paal, S.G. (2024). *Knowledge transfer predictive models for power outage caused by various types of extreme weather events.* In *Proceedings of the 2024 IEEE International Conference on Big Data (BigData)*, pp. 8227–8229. IEEE. https://doi.org/10.1109/BigData62323.2024.10825465

Peer-Reviewed Oral Presentations

[O1] **Lee, J.**, & Paal, S.G. (2025). Harnessing transfer learning to predict power outages from diverse climate hazards. *ASCE Engineering Mechanics Institute Conference*, Anaheim, CA. **[Oral]**

[O2] **Lee, J.**, & Paal, S.G. (2024). A generalized model for predicting power outages in Texas during extreme weather events: Integrating lagged information, geographical, climatic, and socio-demographic data. *EMI/PMC Conference*, Chicago, IL. **[Oral]**

[O3] **Lee, J.**, & Paal, S.G. (2024). A generalized machine learning model for predicting power outages across multiple climate zones. *ASCE Engineering Mechanics Institute Conference*, Chicago, IL. **[Oral]**

[O4] **Lee, J.**, & Paal, S.G. (2023). Ensemble-based time series analysis considering lag information and feature importance to predict power outages during winter storms. *EMI Conference*, Atlanta, GA. **[Oral]**

Peer-Reviewed Posters & Lightning Talks

[PT1] **Lee, J.**, Lee, S.M., & Paal, S.G. (2025). An integrated model for predicting power outages during various types of extreme weather events in Texas. *2025 NHERI Computational Symposium*, Los Angeles, CA. **[Poster]**

[PT2] **Lee, J.**, & Paal, S.G. (2024). Ensemble-based time series modeling for predicting power outages during extreme weather: A multi-factor approach integrating meteorological, geographical, and socio-demographical features. *2024 NHERI Computational Symposium*, Los Angeles, CA. **[Lightning Talk]**

Additional Conference Publications

[ACP1] Park, Y., **Lee, J.**, Son, D., & Choi, C.S. (2018). *An analytical study on ductility capacity of steel fiber reinforced concrete column.* CODE 2018, Changwon, South Korea, 139.

[ACP2] **Lee, J.**, Kim, J., & Choi, C.S. (2018). *Comparison of shear strength models on exterior beam-column joints with steel fiber reinforced concrete.* KCI Proceedings, 30(1), 635–636. (in Korean)

[ACP3] **Lee, J.**, Yoo, M., & Choi, C.S. (2017). *The behavior characteristics of steel fiber high strength RC tied column controlled by both flexure and shear.* KCI Proceedings, 29(1), 797–798. (in Korean)

[ACP4] **Lee, J.**, & Choi, C.S. (2017). *An experimental study on structural performance of SFRC exterior beam-column joints.* Structural Maintenance & Inspection, 21(2), 95–96. (in Korean)

[ACP5] **Lee, J.**, & Choi, C.S. (2017). *Seismic performance of reinforced concrete exterior beam-column joints according to steel fiber volume fraction.* KCI Proceedings, 29(2), 175–176. (in Korean)

[ACP6] **Lee, J.**, Choi, J., & Choi, C.S. (2016). *An experimental study on ductile capacity of steel fiber high-strength reinforced concrete tied columns.* KCI Proceedings, 28(2), 131–132. (in Korean)

[ACP7] Choi, J., **Lee, J.**, & Choi, C.S. (2016). *An experimental study on the shear strength of steel fiber reinforced concrete tied columns.* KCI Proceedings, 28(2), 139–140. (in Korean)

RESEARCH EXPERIENCE

Doctoral Researcher — Jan 2022–Aug 2025

Texas A&M University • Advisor: Dr. Stephanie G. Paal

Architected machine learning frameworks for large-scale power outage prediction across nine U.S. states utilizing comprehensive datasets. Developed and optimized ensemble models (Random Forest, XGBoost, LightGBM, CatBoost) employing Bayesian hyperparameter optimization and explainable AI techniques (SHAP, permutation importance). Deployed near-real-time operational prediction systems and applied transfer learning for data-sparse climate hazard scenarios.

Hands-On Research — Aug 2020–Dec 2020

Texas A&M University • Advisor: Dr. Stephanie G. Paal

Implemented CNN-based steel defect detection using ResNet50 transfer learning with computer vision. Evaluated model performance through comprehensive metrics (IoU, Precision, Recall, F1-Score) and managed validation workflows.

Graduate Research Assistant — Nov 2016–Oct 2017

Hanyang University, Seoul, South Korea • Advisor: Dr. Chang-Sik Choi (NRF-funded)

Conducted comprehensive experimental research on seismic performance of SFRC structures. Designed and fabricated specimens with varying steel fiber volume fractions. Performed cyclic loading tests using hydraulic equipment. Installed and managed instrumentation for real-time data acquisition. Managed specimen design optimization, project budget, and timeline scheduling.

Graduate Research Mentor & Proposal Support — 2018–2021

Hanyang University, Seoul, South Korea • Advisor: Dr. Chang-Sik Choi (NRF-Funded Project, $250,000)

Supported proposal development and technical literature review for NRF-funded project on "Development of Seismic Performance and Displacement-Based Design for High-Performance Reinforced Concrete Squat Shear Walls." Mentored graduate students on research methodology, experimental protocols, and technical analysis.

Undergraduate Research Assistant — Apr 2015–Oct 2015

Hanyang University (ERICA), South Korea • Advisor: Dr. Han-seung Lee

Conducted capstone design research on shear bond strength evaluation of ultra-high-performance cementitious composite (UHPCC).
Received **Grand Prize** recognition at Korea Institute of Building Construction Design Contest.

TEACHING EXPERIENCE

Teaching Assistant — Spring 2023–Spring 2024

Texas A&M University • Zachry Department of Civil and Environmental Engineering

CVEN 363: Engineering Mechanics (Dynamics) Instructor: Dr. Stephanie Paal • Spring 2023, 2024

Conducted biweekly recitation sessions for 60+ students across two semester sections. Developed solution keys, grading rubrics, and supplemental materials. Held weekly office hours and organized exam review sessions.

CVEN 345: Theory of Structures Instructors: Dr. John Mander, Dr. Lee Lowery, and Dr. Stefan Hurlebaus • Fall 2023

Assisted with grading and assessment for 150+ students. Prepared supplemental study materials and organized review sessions.

PROFESSIONAL SERVICE & LEADERSHIP

Memberships

- **Member, Natural Hazards Engineering Research Infrastructure (NHERI) Graduate Student Council** (2024–2025)
- Member, American Society of Civil Engineers (ASCE) (2016–Present)

- Member, American Concrete Institute (ACI) (2016–Present)
- Member, Architectural Institute of Korea (AIK) (2016–Present)
- Member, Korea Concrete Institute (KCI) (2016–Present)

Mentorship

Mentoring 6 graduate and undergraduate students across 3 institutions:

- **Graduate Students:** Olubumi Ogunleye, Nafeezat Ajenifuja — University of Houston (2025–Present)
- **Graduate Student:** Jacob Murphy — Texas A&M University (2022–2025)
- **Undergraduate Student:** Robyn Andrew — Texas A&M University (2024–2025)
- *Former:* Jin-Sung Kim, Ki-Hyeon Kim — Hanyang University (2018–2020)

HONORS & AWARDS

- **Dissertation Fellowship** Texas A&M University **2024–2025**
- **Excellence Fellowship** Texas A&M University **2020–2024**
- **HY-in Scholarship** Hanyang University (Seoul) **2016–2018**
- **Grand Prize** The 10th Construction Technology Competition at the Korean Institute of Building Construction (KIC)
  An Experimental Study on the Shear Adhesion Strength of Ultra-High Performance Cement Composite (UHPCC) According to Surface Treatment Methods at Construction Joints **2015**
- **Honor Scholarship** Hanyang University (ERICA) **2015–2016**
- **Bronze Prize** Capstone Design Competition at Hanyang University (ERICA)
  Developed a 3D-printed concrete mold for evaluating shear bond strength in construction joints.
  2015

TECHNICAL SKILLS

ML & Data Science: Python (scikit-learn, Pandas, NumPy, GeoPandas), TensorFlow, Keras, PyTorch, MATLAB, R

ML Techniques: Ensemble Methods (Random Forest, XGBoost, LightGBM, CatBoost), Transfer Learning, Neural Networks (CNN, RNN), Bayesian Optimization, Explainable AI (SHAP)

Engineering Software: AutoCAD, Revit, SketchUp, SAP2000, ABAQUS, QGIS, ArcGIS

Other: Adobe Photoshop, Microsoft Office Suite, LaTeX

WORK EXPERIENCE

Design Assistant (Part-time) — Jun 2014–Aug 2014

In-dong Architectural Firm, Seoul, South Korea

Assisted in building design competition concept development and presentation materials. Designed the building using SketchUp, created AutoCAD floor plans and elevations, and made a 3D model with foam board.

Teaching Assistant (Part-time) — May 2015–Dec 2015

Perfect Knowhow (PK) Dok-hak Jae-su Academy, Seoul, South Korea

Managed classroom administrative tasks and delivered lectures. Assisted in creating and grading examination papers and assessments.

REFERENCES

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